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Unified approach to approximate quantum error correction via the transpose channel PRABHA MANDAYAM, The Institute of Mathematical Sciences, Taramani, Chennai - 600 113, India, HUI KHOON NG, DSO National Laboratories, and Centre for Quantum Technologies, NUS, Singapore — Much of the existing work on error correction focuses on the standard paradigm of perfect quantum error correction(QEC), where the recovery operation perfectly reverses the effects of a noise channel. Recent studies on approximate QEC(AQEC) have demonstrated possible advantages that arise from relaxing the requirement for perfect correction. However, while the recovery operation for perfectly correctable codes is well-known, finding the recovery for approximately correctable codes often requires difficult numerical procedures. We demonstrate an analytical, universal and near-optimal recovery map-the transpose channel- for AQEC codes, with optimality defined in terms of the worst-case fidelity. Using the transpose channel, we provide an alternative interpretation of the QEC conditions and generalize them to a set of conditions for AQEC codes. This forms the basis of a simple algorithm for finding AQEC codes. Our analytical approach is a departure from earlier work relying on exhaustive numerical search for the optimal recovery map, with optimality defined based on entanglement fidelity. Our results can also be extended to the general case of approximate operator quantum error correction, thus bringing us closer to a unified, analytical framework for AQEC.(Ref:PRA,81,062342(2010))

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